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ADVANCED RAIL TECHNOLOGY

REPORT

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SUBCOMMITTEE ON
TRANSPORTATION, AVIATION AND MATERIALS

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LETTER OF SUBMITTAL

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, D.C., August 1982.

Hon. DON FUQUA,
Chairman, Committee on Science and Technology,
U.S. House of Representatives.

DEAR MR. CHAIRMAN: The transportation infrastructure of the United States is perhaps the most elaborate and extensive in the world. However, in spite of the advantages of that infrastructure, elements of our transportation system are already congested.

Forecasts indicate that unless there are massive investments in maintenance and capacity expansion, nearly one-third of our commercial airports will have reached saturation by 1990.

In addition, by 1990 our interstate highway systems will be operating at nearly 150 percent capacity in 27 States, and increased movement of coal will choke segments of our rail system.

Railroads continue to face the problem of obsolete and deteriorated track, facilities and equipment caused to some extent by inadequate earnings.

While Japan, France, Germany, and other countries are making significant advances in high speed rail technology, the U.S. rail system continues to deteriorate at an escalating rate.

While the Japanese bullet train is producing a substantial profit, many in the United States continue to insist that passenger trains cannot be profitable.

While the French TGV set the world speed record of 236 miles per hour, many continued to insist that passenger trains cannot practically move faster than they do today in the United States.

Americans have been diverted from, but have not lost their great love and respect for transportation by rail. High-speed rail technology could provide us with the means to take the pressure off other modes of transportation since it is an energy efficient and potentially competitive option for short and intermediate range passenger travel.

It was with these issues in mind that the Transportation, Aviation and Materials Subcommittee held hearings on Advanced Rail Technology April 5 and 6, 1982.

This report summarizes the hearings and offers findings and recommendations based on staff investigations and expert testimony.

With best regards,

DAN GLICKMAN,
Chairman,
Subcommittee on Transportation, Aviation and Materials.

I. INTRODUCTION AND OVERVIEW

On April 5 and 6, 1982, the Subcommittee on Transportation, Aviation and Materials held hearings on the subject of Advanced Rail Technology and the Future of American Transportation. The purpose of the hearings was to assess the technological needs and opportunities of American rail transportation in order to lay the basis for future national transportation policy. Although the general focus of the hearings was on rail technology, interrelated economic and regulatory issues were also discussed.

Subjects considered at the hearings included conventional high-speed rail technology and magnetic levitation rail technology, technology transfer and rail industry innovation, the technological and economic feasibility of establishing dedicated high-speed rail corridors in the United States, and the proper role of the federal government in promoting the development of a balanced national transportation system.

Background

The United States' transportation infrastructure is perhaps the most elaborate system in the world. The U.S. has the world's most extensive system of highways, the largest automotive and truck fleets, the most technically advanced system of air traffic control, the greatest fleet of aircraft, and an extensive system of canal and inland waterways. Our railroads are the most extensive in trackage and equipment in the world, and we are building some of the world's most advanced urban mass transit systems.

In spite of those advantages, elements of the transportation system are already congested, many are approaching the end of their design lifetimes, and maintenance requirements are limiting the performance of others. The rate of productivity is now declining. Although the transportation industry had a respectable 2.9 percent rate of productivity growth between 1965 and 1973, this rate fell to 0.9 percent during the period from 1973 to 1978. Forecasts indicate that unless there are massive investments in maintenance and capacity expansion, by 1990 nearly a third of the commercial air-carrier airports will have reached saturation, interstate highway systems will be operating at nearly 150 percent of design capacity in 27 states, and increased movement of coal will choke segments of the rail system and interface with the flow of other commodities.

Rail Transportation

Rail is an energy efficient transportation mode especially suited for long distance and bulk transport of commodities. It is also an efficient and potentially competitive option for short and intermediate range passenger travel. Nevertheless, the railroads have steadily lost market share for both passenger and freight traffic since World War II.

The major causes for the decline in U.S. rail transportation since World War II are broadly recognized and have been summarized by the Department of Transportation:

> Changes in the nature of the freight transportation market and increasing competition from other modes.
>
> Government regulation of the railroads and subsidy of competing modes.
>
> Structure of the railroad industry and labor-management relations.

These general causes give rise to specific problems which are frequently cited:

> The average scheduled speed of a freight train is 20 miles per hour; for a passenger train, it is 46 miles per hour. Significant improvements in these speeds are technologically achievable.
>
> The present lack of reliability for rail freight and passenger service is accepted within the industry as inevitable. Speed and reliability are both degraded by inefficient terminals and substandard physical plant.
>
> The industry requires high capitalization but experiences low equipment utilization. The inventory of 1.6 million freight cars has a 12 percent utilization rate.
>
> Much equipment and many operating procedures are technologically obsolete. Failure to innovate has led to loss of market share in transporting many commodities.
>
> There will be a shortfall of $13 to $16 billion in the railroads' ability to raise needed capital over the next decade. There is already a backlog of deferred maintenance and capital improvements that exceeds $6 billion.

Actions are being taken to deal with some of these problems. Deregulation will provide increased revenues and result in the railroads' becoming financially stronger. Mergers also will enhance the financial base of the fewer remaining companies. When placed in context of the requirements of the year 2000, however, there is a serious question as to whether these financial gains will be sufficient. Further, there is little in either the deregulation or merger approach that will guarantee improvements in rail productivity or facilitate aggressive movement toward a more integrated transportation system.

Although similar labor and market forces have been at work in other industrialized nations, other countries have moved in different directions. In Japan, a policy decision was made to construct an entirely new railroad system for higher speed passenger service. The result was the Shinkansen, designed for speeds of up to 168 MPH, and grossing more than $3 billion in 1978 with total overall expenses of $1.7 billion. That approach has been followed by the French with the development of the TGV, designed for speeds of 200 MPH, and to some extent by the British, Germans and Italians.

In the United States, a number of organizations are looking at the opportunities presented by advanced high-speed rail technologies. Amtrak has been working seriously to determine the commercial feasibility of high-speed passenger train service and their preliminary analyses indicate that profitable operations are possible in proper transportation corridors. Because Amtrak cannot be used to attract private finance, the American High Speed Rail Corporation was established

to test initial projections of profitability, arrange for private financing, and to construct and operate new systems, beginning with the San Diego to Los Angeles corridor. The State of Florida has established a Florida High Speed Rail Committee which is working with the American High Speed Rail Corporation to conduct feasibility studies on the potential for development of the Miami-Tampa-Orlando corridors. The State of Ohio, through the Ohio Rail Transportation Authority, is planning to construct a high speed rail system on the Cleveland-Columbus-Cincinnati and Toledo-Cleveland-Youngstown corridors, pending passage of a 1¢ sales tax to finance the system. The City of Las Vegas has contracted with the Budd Company, America's only existing designer and builder of rail cars and owner of the exclusive rights to the Skytrain magnetic levitation technology, to conduct feasibility studies on the development of the Las Vegas-Los Angeles corridor.

High Speed Rail Technology

It was the consensus of a wide variety of rail experts that high speed rail technology is readily available. In fact, the Metroliner, designed and built by the Budd Company, was operated in the United States at a speed of 160 miles per hour in 1969. However, the average speed of current Metroliner operations in the Northeast corridor is much lower due to the severe contraints of worn track and competing freight operations. In short, although high speed technology has been available, the application of that technology to intercity passenger transportation in the United States has been sporadic.

The history of development rail passenger technology in Japan and Europe has been quite different. Ongoing research and development programs, supported by the national railroads, have continually upgraded and improved technology.

About the same time that the Congress persuaded Presidents Kennedy and Johnson that train service should be restored in the Northeast Corridor, Japan decided to develop high speed rail. By mid-1959, it tested rail at speeds of 163 kilometers per hour. By 1962, its tests were at 256 kilometers per hour. By the end of 1964, the bullet train was operational as an environment efficient, environmentally protective, safe, and profitable alternative to highways and airways. Today, the bullet train system is 662 miles long. One-third of the route is tunnels and one-tenth is overwater bridges. It has carried more than 1.8 billion passengers without a fatality. The Shinkansen line, with 275 daily trains, is inspected daily by instrumented inspection trains and walking track inspectors. The line is closed every evening to allow replacements of worn or defective rails, rail grinding, ballast tamping, tightening of rail connections, and other maintenance.

France entered a new era on September 27, 1981 when its new TGV began service on the new Paris to Lyon track. The train operates at 160 miles per hour. France is now planning a second high speed electric line from Paris to connect with existing trackage to western and southwestern France.

The British have developed the Advanced Passenger train which runs curves at 125 miles per hour and reaches 160 miles per hour in tests. Although some operating problems exist, the train can operate on conventional track with tight curves at high speeds.

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Australia is about to enter regular service with its new Express Passenger train, a high performance, self-contained diesel-electric intercity express passenger service.

The Budd Co. has acquired the rights to a German ultra-high-speed passenger system in which vehicles are magnetically levitated, guided, and propelled along an elevated guideway at speeds of more than 250 miles per hour. The mag-lev system is described as flying at ground level with a propulsion system which has no moving parts to cause vibration. The mag-lev system dispenses with the conventional steel wheels on steel rails concept and operates free from traditional railway limitations.

In 1975 the Improved Passenger Train Service Conference at Carnegie-Mellon University concluded that it was then time to implement the technological developments.

Five years later at the same university, the First Rail Systems Technology and Operations Symposium sponsored by the Federal Railroad Administration concluded that:

> Foreign technology has shown the way toward high speed passenger services. These capabilities can be made available in the United States at considerable cost and, with a high level of personal dedication on the part of the Government, the operators, the designers and the public.

IPEEP, otherwise known as the Improved Passenger Equipment Evaluation Program, the 1977 sequel to IPT, otherwise known as the Improved Passenger Train, conducted detailed systematic evaluations of advance trains and equipment in operation or development throughout the world. Its conclusion:

> The eighties offer a great future and challenge to rail passenger service if we heed the work of others, move slowly but deliberately, and do not attempt to overstep reality.

II. FINDINGS AND RECOMMENDATIONS

(1) Economic Impact of High Speed Rail Technology

The Subcommittee finds that the development and utilization of high speed rail systems technology could act as a catalyst for economic growth, and could be a key factor in the reindustrialization of America. The Subcommittee recommends that Congress consider the development of high speed rail corridors as a key component of future national economic policy.

(2) Developing a Balanced National Transportation System

The Subcommittee finds that U.S. rail transportation is underdeveloped and shows the most potential of any transportation mode for expansion. The Subcommittee recommends that Congress authorize a concept validation analysis to test the feasibility of establishing a national high speed rail right-of-way system, and to explore alternative implementation planning for the development of a balanced national transportation system utilizing high speed rail systems.

(3) Conventional Advanced High Speed Rail Technology

The Subcommittee finds that conventional high speed rail technology has been readily available for many years, but that Amtrak and the U.S. rail industry have failed to utilize existing advanced technology to improve rail transportation. Consequently, the United States is currently years behind other industrial nations in the development and utilization of innovative high speed rail systems technology. The Subcommittee recommends that Congress explore methods of insuring and expediting the transfer of high speed rail systems technology from other countries to the United States through cooperative agreements with foreign governments and industry in order to stimulate and revitalize the industrial and technological base of the U.S. rail industry.

(4) Magnetic Levitation Technology

The Subcommittee finds that Japan and the Federal Republic of Germany have made significant advances in their development of magnetically levitated (MAGLEV) super high speed rail systems, and that their MAGLEV systems could be operational as early as 1984 in Germany and 1992 in Japan. The Subcommittee finds that the United States has failed to utilize its scientific and technological capabilities to develop American magnetic levitation technology for use in inter-city high speed rail systems. The Subcommittee recommends that Congress design a program for advanced research and development of magnetic levitation technology utilizing the propulsion expertise and facilities located at NASA's Lewis Laboratory.

(5) Potential Markets and the Relationship Between Profitable and Unprofitable Corridors

The Subcommittee finds that potentially profitable markets currently exist for dedicated high speed rail systems in twenty high population density corridors with major cities from 100 to 300 miles apart. The Subcommittee further finds that long distance routes will probably continue to require subsidization unless the revenues from profitable routes are used to defray the operating costs of long distance routes. The Subcommittee recommends that the American High Speed Rail Corporation continue development of the Los Angeles-San Diego corridor, while also exploring the feasibility of other potentially profitable corridors. The Subcommittee further recommends that the American High Speed Rail Corporation and Amtrak explore the feasibility of establishing an innovative relationship whereby the profits produced by the American High Speed Rail Corporation are used to defray the costs of Amtrak's long distance routes in exchange for rights of ways and other services provided by Amtrak and the U.S. Government.

(6) Financing Alternatives

The Subcommittee finds that although there is substantial private sector interest in the financing of potentially profitable high speed rail corridors, there has been little cooperation between the public and private sectors. The Subcommittee recommends that both private and public financing should be encouraged by the authorization of loan guarantees or other financing mechanisms in order to assure that a mix of various financing alternatives are fully utilized.

III. SUMMARY OF TESTIMONY BY ISSUE

A number of key specific issues were addressed at the hearings. They were as follows:

(A) The Availability of Advanced High Speed Rail Technology

Mr. Robert Blanchette, Administrator of the Federal Railroad Administration, indicated that there are no technological barriers to the establishment of high speed rail systems:

> We have the technology. The problems we have always had with high-speed passenger service is not a technological one.
>
> It may be recalled that in 1969 the Metroliner operated on the Northeast corridor at 160 miles an hour not kilometers, Mr. Chairman, 160 miles an hour on a track which was specially prepared for the purpose. That is quite some time ago. That Northeast corridor today, with the terrible impediment of having to run over a mix of freight and commuter service, is nonetheless geared up for 120 miles-an-hour speed, which is in my judgment fantastic, considering the mix of service that runs on that corridor. So there is no technological impediment.
>
> [The problems are] . . . primarily economic and environmental. It is not possible, in my judgment, to construct a railroad right-of-way at 160 miles an hour over a roadbed that operates freight service. The Japanese have demonstrated that and the French have demonstrated that. Their rights-of-way on the Shinkansen TGV are on solely dedicated rights-of-way.

Dr. William Harris, Jr., Vice President, Research and Test Department of the Association of American Railroads, commented on high speed passenger rail technology:

> There is no question in my mind we can develop that technology. That technology requires several things, however. It requires a separate track structure. Mixing heavy freight and those kinds of high speed traffic has not proved to be satisfactory. Indeed, as the Japanese may indicate to you, the Shinkansen was designed to run freight at night and passenger trains during the day. Because they require all night to tune the track, to put it back in a mode where it can accept the high speed passenger service in the morning, they have not been able to run freight at night. This same is true surely with the TGV. I know people who developed the TGV system. They assured me there is no way they can accommodate freight on that line.
>
> I say unequivocally the technology could be developed.

Dr. Thomas Webb, Director of Development, Dalton, Dalton, and Newport added:

> Yesterday you discussed that high speed rail was not a new and exotic technology and I agree. But it does require that it be a fully integrated technology, the track, the catenary, the vehicles, the geometry and the signaling has to be a single system and it can't be done on a rail that runs 100-ton freight cars.

Mr. Robert Casey, Executive Director of the Ohio Rail Transportation Authority responded to a question about high speed rail technology:

> Mr. GLICKMAN. There is an implication I think in your statement that advanced foreign technology is critical to your system. You talk about foreign technology. We have demonstrated domestic technology can operate trains at 150 miles an hour. We just have not seen fit to commercialize that technology.
>
> Mr. CASEY. We in Ohio have plans for a test track on which we will test both foreign and domestic trains to determine which technology will be the most appropriate for our state. And I agree with you that the technology is not the big secret, the big secret is the dedicated right-of-way, because you cannot have any interference with a train going 160 miles an hour.

Mr. John Dwyer, Vice President of General Electric-Locomotive Division indicated that high speed rail technology is widely available:

> The absolutely essential point here is that there are no technological secrets possessed by railroad operators and equipment manufacturers in other parts of the world relating to making a train run fast and safe.
>
> It is fundamentally a question of establishing the need, the objective, the economics and defining the parameters. The tchnology is well and widely known within United States industry.
>
> Train operation at speeds of 150–160 miles per hour requires such drive system components as fully suspended traction motors to reduce unsprung weight. This design concept is supplied by U.S. manufacturers for commuter and transit cars, and can be supplied, if required, for locomotives as well.
>
> Existing U.S. traction motor technology is entirely suitable for high speed service as well. Traction motor horsepower will be determined by running time requirements, vehicle weight and the choice between locomotive hauled or multiple unit trains, and, again, the technology is well-known.
>
> In the field of power conditioning for the drive system, there can be a choice between electro-mechanical and various forms of thyristor control.
>
> The most critical item required for continued high speed operation is the track, where, again, new technology is not required. The barrier here is economic, not technical.

Mr. Dagobert Scher, General Manager for North America, French National Railroads, responded to questions on the TGV technology:

Mr. GLICKMAN. Let me get to the technology.

You have basically said that there is really no exotic technology involved in this railroad.

Mr. SCHER. Correct.

Mr. GLICKMAN. That is, everything that you used is technology that is available to anybody in the world?

Mr. SCHER. Correct.

Mr. GLICKMAN. No exotic materials used?

Mr. SCHER. None whatsoever.

Mr. GLICKMAN. Were there any technological advances? For example, I am told you have reduced the unsprung mass with fully suspended traction motors.

What I am trying to get at is what do you have in there that we did not have before?

Mr. SCHER. All right. What that means is that normally on the locomotives your traction motor is attached on the bogie of the train. We took these and attached them on the underframe of the body and with a, how do you call it, a rod similar to your car, we direct that motor to the wheel to create the movement.

So actually the unsprung mass is really because we attached the motor to the frame of the body rather than to the trucks. That is really what it is.

So it is not new technology, it is something that we decided to do. It is just that we discovered that there was a preferable system to use.

Mr. GLICKMAN. There you were being ingenuous with existing technology?

Mr. SCHER. Exactly.

Mr. GLICKMAN. But in terms of materials?

Mr. SCHER. The materials are the same. You are using track that has a deeper ballast. You are using electrification, which is normal; you are using an articulated train. You are lowering the body of your cars really like the Talgo train, in Spain. So it is really nothing new in that respect.

Mr. William Dickhart, Assistant to the Technical Director, The Budd Company, commented on their developments in high speed rail technology:

We at Budd are convinced that we stand at the threshold of a new technology era in the rail transportation industry. We believe we have a proven technological concept which can, in a significant way, help simultaneously meet the challenges of reindustralization, jobs creation, and state-of-the-art technological innovation. At the same time, substantially lessen our existing dependency on foreign oil and make a major contribution toward enhancing the environment.

Mr. Chairman, this dramatic technological advancement is, put simply, a train that flies.

Skytrain constitutes a quantum technological leap beyond any existing conventional rail system. It incorporates technol-

ogy which magnetically leviates passenger cars above an elevated guideway.

The Skytrain is an ultra-high-speed transport system in which vehicles are magnetically levitated, then propelled along an elevated guideway at speeds of 250 miles an hour.

This technology, known as "Maglev," allows the Skytrain to literally "fly" above ground level. This system is being offered by Budd, which has the exclusive rights in the Western Hemisphere from its sister company, Thyssen Henschel of Kassel, West Germany. Thyssen and its associates have been developing this system for over a decade in Germany and in 1979 operated the first Maglev system in the world approved for passenger transport.

Final full-scale testing of a 200-passenger vehicle on a 20-mile guideway will begin this summer in Emsland, Germany and the first completed Skytrain could be built and put into service by the mid-1980s.

Mr. James Harp, Manager of Program Development for Northrop Services, Inc., summarized the technological feasibility issue:

> In the technical jargon of the industrial innovation analysts we see the favorable congruence of "demand pull" and "technological push" forces. We see a "demand pull" situation in which the present transportation infrastructure is not adequate—nor can it be easily structured—to serve even the low-growth forecast for transportation requirements in the year 2000. We see a "technology push" situation characterized by proven foreign high-speed rail systems, as well as advances in communications, and transmission of electrical energy that have far reaching implications for our national logistics posture. To address this challenge we must remove the blinders of modal bias and look with a macro view at the problems, our present capabilities, and our resources. Then in the American tradition apply imaginative innovation and develop a solution that will recapture our leadership and satisfy our economic and strategic needs well into the next century.
>
> There have been few moments in history when so many essential elements necessary for an innovation of this magnitude have been in place. I firmly believe that the necssary political, social, and environmental ingredients are present. Our economy needs a catalyst, the technology is here, the time is now. What is needed is the leadership, and the bold decision to move ahead to the 21st century.

Congressman Adam Benjamin, Chairman of the House Appropriations Subcommittee on Transportation, concluded:

> I am convinced that existing economic and technological conditions, as well as serious congressional interest, signal the threshold of a new rail passenger era in the United States—predicted on intercity high speed corridors and automated rapid intracity transit.

(B) Key Characteristics and Potential Markets for High Speed Rail Passenger Service

Congressman Adam Benjamin, Jr., Chairman of the Appropriations Subcommittee on Transportation, commended on the characteristics of high speed rail corridors in other countries:

> Railways dominate intercity transportation travel in Japan and Europe. There, government planned systems include financed or supported railroads which prevented any significant deterioration of rail travel. Demographic and land-use characteristics key to rail's competitive position in other countries include:
>
> (1) Densely developed urban areas located in 100–300 mile corridors.
>
> (2) Highly developed public transportation providing good access to rail stations.
>
> (3) Low automobile availability and high air travel costs.
>
> These characteristics are also found in certain population corridors in the United States. While it may not be feasible to have a bullet train, "flying peacock" or mag-lev train in every population corridor, a balanced system and the mix of passenger transport should be encouraged and determined by the predominant demographic cost, and technological needs of the geographical area.

Dr. Thomas R. Webb of Dalton-Dalton-Newport reported their findings on potential markets for high speed rail:

> High speed rail service is competitive for trips between high-density population centers that range from 100 to 300 miles apart. There is a very clear niche in the travel market for this system. It is not a short-haul system, automobiles are far more competitive in almost all aspects. Nor is it competitive on the very long trips where the airplane demonstrates clear advantages. It happens that this 100 to 300 mile trip is the one major market segment that no current transportation mode services very well. We have all heard or said such statements as: "It takes me just as long to fly there as drive," or "A really confortable car trip is a couple of hours, over that it gets to be a hastle." Thus, we have a market segment that is not served well which creates the market opportunity for a high speed rail system.

Dr. Koji Takahashi, Senior Vice President for Engineering of the Japanese National Railways outlined several key characteristics of the Shinkansen:

> During the 17 years of Shinkansen operation, the average travelling distance per passenger has hovered around 200 miles. That and the fact that the Shinkansen has been able to capture at least 80% of the passenger market between Toyko and Osaka, 320 miles apart, has led us to believe that

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our Shinkansen is competitive with other modes of transportation in medium-length or 100 to 500 mile intercity corridors.

The increase in ridership in the Toyko-Osaka corridor for 1970—after 5 years of operation—was more than one and one-half times our optimistic estimate. The actual daily ridership grew by 300% in those first five years.

Now, what has caused this huge increase in traffic volume? The high frequency of service and the very convenient reservation system have no doubt contributed. But I believe the greatest cause lies in the accident-free and highly punctual service offered, which has become all the more evident as the years went by. In 17 years of actual service, the Shinkansen has carried 1.7 billion passengers without a single accident or passenger injury—a safety record unmatched in the transportation field.

The safety and dependability, in addition to the speed and convenience, of this system has drawn passengers in huge numbers and that means a large income. In fact, the Shinkansen is the star money-maker with an income of 3.17 billion dollars as opposed to expenditures of 1.87 billion dollars, yielding an operating ratio of 59 percent. Personnel expense accounts for less than a quarter of the total expenses, while it is over one-half for JNR as a whole, indicating that the entire system—in and of itself—has one of the characteristics of a finely-tuned machine.

Dr. Koji Takahashi responded to questions on this issue:

Mr. GLICKMAN. In your assessments of the U.S. market, what corridors or what part of this country do you feel would be economically suitable for a Shinkansen-type high-speed system?

[Mr. Takahashi responded in Japanese; his remarks were interpreted into English by Mrs. Gregg.]

Mr. TAKAHASHI. I feel that the high-speed Shinkansen type transportation mode is most suitable for areas with rather dense population between two cities situated 200 to 300 miles or even 400 miles apart.

Mr. BENJAMIN. What makes you think we could operate high speed rail at a profit?

Mr. TAKAHASHI. I am not an expert on transportation in America, but I feel that you could build a transportation system that would operate at a profit if you fulfilled the following conditions: If before building the system, you chose the least costly construction methods, then if you built a system that was as mechanized or automated as possible, and you must make a system that can be operated at the least possible cost. It is possible to operate both commuter transportation systems and high-speed systems at a profit.

Mr. Dagobert Scher, Assistant General Manager for North America, French National Railroads, commented on the key factors in generating consumer support for high speed rail systems.

The only thing, if I may add, is that in order to get that support from the public, you need two things; not only high

speed, because if you have high speed and you have one train a day, nothing happens. You have to have the high speed with the frequency.

People have to have the feeling that when they get to the terminal they have a shuttle that goes out practically every hour, exactly like the Eastern shuttle here. If you let them stand at the terminal for two or three hours, you have lost, because the speed you gain is lost by their wait at the railroad station.

So it shows that really the frequency is a very, very important aspect of your operation.

Mr. Robert Casey, Executive Director of the Ohio Rail Transportation Authority made a similar point:

> How can you get people interested? If you have a train every hour or half-hour, as prior witnesses mentioned, this is one of the secrets of the new technology, if you will.
>
> The computer studies and the various studies we have undertaken have indicated there is a market there, if you provide the right kind of service.
>
> It is a matter of, if the train is available, people will ride it.

Congressman Reuss, Chairman of the Joint Economic Committee, presented a summary of their economic analysis of high speed rail which included conclusions on potential markets:

> The average speed needed to make rail service viable is primarily dependent on the travel time of competing modes The total trip must be fast enough to provide an incentive for travelers to leave the train's major competitor—the automobile. Service on the successful high-speed trains in France, Britain and Japan is comparable to the airlines. The average speed of their trains is over 100 miles per hour. At a minimum, service in the United States must be comparable to the passenger operations in those countries.
>
> Another important factor is the frequency of service. In order to provide the traveler with convenient service, trains should be operated almost hourly and with service to all major intermediate points. Infrequent service does not allow most travelers the flexibility and freedom they need when planning trips. Amtrack President Alan Boyd echoed these views when he stated at the July 23, 1981 Joint Economic Committee hearing that, "Experience in the Northeast corridor has proven that people will leave their cars and take the train on trips of generally 100–300 miles if they are provided frequent, reliable, safe, and comfortable service."
>
> The final major factor which needs to be considered in developing a competitive passenger rail system is the population density in the area served. In order to generate enough ridership, a route must not only connect two major cities, but also serve a heavily-populated region which includes a number of intermediate-sized cities. The high-speed trains in Europe and Japan run through the most densely populated areas in the country. In addition to the Northeast Corridor

(Boston-Washington, D.C.), there are a number of regions in the U.S. where population densities approach the levels in Europe and Japan. These include:

(1) Atlanta, GA, to Nashville, TN;
(2) Atlanta, GA, to Savannah, GA;
(3) Boston, MA, to New York, NY, to Washington, D.C;
(4) Boston, MA, to Springfield, MA, to New Haven, CT;
(5) Cleveland, OH, to Columbus, OH, to Cincinnati, OH;
(6) Chicago, IL, to Indianapolis, IN, to Cincinnati, OH;
(7) Chicago, IL, to Cleveland, OH;
(8) Chicago, IL, to Detroit, MI;
(9) Chicago, IL, to St. Louis, MO;
(10) Chicago, IL, to Milwaukee, WI;
(11) Los Angeles, CA, to Las Vegas, NV;
(12) Los Angeles, CA, to San Diego, CA;
(13) San Jose (Bay Area), CA to Sacramento, CA, to Reno, NV;
(14) Miami, FL, to Jacksonville, FL;
(15) New York, NY, to Albany, NY, to Buffalo, NY;
(16) Philadelphia, PA, to Atlantic City, NJ;
(17) Philadelphia, PA, to Harrisburg, PA;
(18) Seattle, WA, to Portland, OR;
(19) Houston, TX, to Dallas-Ft. Worth, TX, to San Antonio, TX (the Texas Triangle);
(20) Washington, DC to Richmond, VA.

The Joint Economic Committee, as its name suggests, bears down heavily on economy. We are struck by the fact that, if you want to make the operation economically self-sufficient, free of subsidy, repaid at the fare box, you probably have to stick to the twenty leading two- or three-hundred mile corridors because that is where the traffic is.

That is not to say that it may not be a perfectly fine use of public funds to subsidize, moderately at least, long-run passenger trains like Chicago to Seattle, Chicago through Kansas City to Los Angeles, and so on. But we have not been able to find that those would be economic.

Mr. Lawrence Gilson, Vice President for Corporate Development of AMTRAK comments on their activities and analysis of potential corridors:

In our efforts to pursue the high-speed rail project, Amtrak has arranged for Japanese financing for the conduct of preliminary engineering feasibility studies, conducted by teams of engineers drawn from the group at the Japanese National Railways responsible for the design and construction of the famed Shinkansen "bullet train" lines. We have also brokered the creation of a new private company, the American High

Speed Rail Corporation. This new company, of which I am honored to be President, is coordinating the conduct of feasibility studies, arranging financing, will oversee the construction of the new high-speed lines, and operate the systems in those cases where the new company is involved.

I would like to describe certain of the conclusions which we have reached about the conditions which must be present in the United States in order to make the introduction of high-speed rail service a practical reality. These factors include at least:

(1) high-density, heavily traveled transportation corridors in which existing transportation alternatives are strained to capacity;

(2) access to a proven technology in order to avoid the necessity of engaging in extensive, expensive research and development; (a need to engage in such an R&D phase as a prelude to design and construction of an American high-speed train would certainly foreclose the possibility of financing the project with private funds);

(3) availability of already assembled rights-of-way or large elements of a right-of-way which could be assembled without extraordinary cost or time delay;

(4) we believe that a relationship should exist between whoever does operate the high-speed trains and Amtrak so that that entity, whoever it is, can acquire the necessary operating rights if the route is one for which Amtrak has exclusive rights today, and in order to arrange for the shared use of the Amtrak national reservations system, stations, coordinated schedules, et cetera;

(5) strong support from Federal, State, and local leaders in order to help address permitting, licensing, taxing, and a myriad of other problems which inevitably arise with any project of this magnitude and complexity.

And finally, (6) heightened understanding in the American financial community of the factors which distinguished the economics of high-speed trains from other kinds of railroad financing projects, including the record or profitability high-speed trains have exhibited in other parts of the world.

The studies conducted to date give us a high level of confidence that the necessary conditions which I have just listed either now exist, or can be made to exist.

At least with regard to Los Angeles to San Diego, and certainly we expect with regard to other routes, we are optimistic that high-speed trains will come to the United States, and that it can happen soon. Once the threshold has been cleared and the financing for the first project has been arranged, we believe the demand for development of other routes will be so great, and the prospects for arranging financing so enhanced, that we will in fact be creating a new industry in the United States.

(C) Financing Alternatives

Congressman Glickman and Congressman Winn asked Congressman Reuss about the cost of high speed rail:

Mr. Glickman. What about a cost figure? Have you put any numbers down in terms of how much it would cost, let's say, to put high speed rail corridors in 20 markets in this country?

Mr. Reuss. That really depends, Mr. Chairman, on detailed studies of each of the corridors. Then you add them up.

Fortunately, Amtrak and FRA are doing that, and we can't second-guess them. We are going to wait for them.

I would say, however, that whatever the cost, we do know from the French and Japanese that high speed passenger rail in the proper corridors is completely cost-effective and results in zero subsidy and in the repayment of capital costs. That is what we are interested in. We think it can be done, and I know enough about financial markets to know that, if there is a plan in being, backed perhaps by some kind of a relatively costless Government guarantee, private capital would flow just as private capital flowed to Morgan Stanley to build the French Tres Grande Vitesse.

Mr. Glickman. Is Morgan Stanley a U.S.-based investment house?

Mr. Reuss. Yes.

Mr. Glickman. They essentially financed the French TGV?

Mr. Reuss. They were a large part of the syndicate. They glommed onto many an American dollar to do part of that. Far from objecting, I think that is fine. The world is better off.

The American investors are clipping a nice coupon as a result of it. It simply shows if we could get Morgan Stanley to look homeward, angel, we could do it here.

Mr. Glickman. Thank you.

Mr. Winn?

Mr. Winn. Thank you, Mr. Chairman.

I was interested in your statement there about a relatively costless Government guarantee.

Henry, I don't quite understand what that is.

Mr. Reuss. Yes, I should make clear what I mean. I am talking about a Government guarantee which, it is reasonably clear, will never have to be called, but which by its very existence reduces the amount of money the bond issuer has to pay. It would reduce the amount of interest from—and we hope that when we get around to doing this the figures will be less than the current figures—an outrageous 15 percent to a much less outrageous 11 percent, let us say.

Let's take the Chicago-Kansas City corridor. Everything you have said about the sorry condition of those lines is true and is replicated throughout the country.

I believe there are seven main rail lines between Chicago and Kansas City. I would think it would be wise to pick the best—that with the least curves, the least traffic congestion—and make that the base of your high-speed passenger corridor. This is the most wonderful adaptive re-use of what you might call a historic landmark—the Atchison, the Milwaukee, and all the other railroads that one could possibly imagine.

Like any other proposition which seeks the favor of private investors, this has to be put together so that it meets with favor when the gimlet eye of Wall Street is applied to it. I believe that could be done. The only way to find out is to try.

It is now being tried in Los Angeles-San Diego.

I would hope that we could move ahead fast enough and on enough corridors so that two conditions could be met: one, so that Wall Street gets in the habit of evaluating these prospects to see whether my proposition is true that a cost-free Government guarantee actually would swing it; and, second, for political reasons.

I can put together a coalition to do 10 or 12 corridors a lot faster than I could put together a group to fix up Chicago to Milwaukee, let us say, or Chicago to Kansas City.

But that is fair. This isn't a boondoggle, a logrolling, or back-scratching operation. The fact is, these 20 corridors represent good bets for subsidy-free operation.

Mr. WINN. You are talking about a Government guarantee then. Of course, when the Government steps in to guarantee any of those things, it detracts from the credit of the Federal Government.

Mr. REUSS. That is true. I am not sure that a Government guarantee would be needed.

I am not sure that, with private/public cooperation, you can't put together something which would prove itself as commendable to the private market as the Argentine railroad did 100 years ago.

Mr. WINN. Particularly if the Federal Government decided that this was one of our top priorities. Then I think the private industry and everybody else might come in.

If we don't, if we are lackadaisacal and wishy-washy about what we really want to do—which we have been for quite some time—then I don't know that outside money would become available.

Mr. REUSS. You have said it all, Congressman Winn, right there.

What it needs is dynamic leadership, and we have some precedents that I have cited for that kind of leadership. Then who knows? I don't know if you have been up to Harbor Place in Baltimore, 30 miles from here. There is a magnificient thing that was done because an innovative private citizen marshalled the capital, the architecture, the planning, and the know-how. Sensible mayors and governors and other public officials climbed on to help overcome the obstacles, but basically Harbor Place in Baltimore is private.

It isn't a large public park or venture. That same spirit, I

think, has to govern our passenger rail. You summed it up very well.

Mr. WINN. Do you think there is any U.S. firm that is capable of building a bullet-type train like they have in Japan and France?

Mr. REUSS. Yes.

Mr. WINN. Many of our railroad builders and contractors have gone out of business.

Mr. REUSS. Yes. The Dunes south of Chicago are full of the sarcophagi of ruined train builders, but there are some left. There's Budd, which I think is going to testify.

There is an important Chicago company which now has some kind of licensing agreement with the foreigners.

I don't exclude bringing in—domesticating—foreign firms to provide jobs and good products here in America. That doesn't bother me in the least, if they are going to hire Americans to do what needs to be done.

Dagobert Scher of the French National Railways commented on the financing of the TGV:

> Contrary to what many people in this country seem to think, this project was entirely financed by the French national railroads without any Government subsidy or any money coming from the taxpayer.
>
> The funds required came from— one-third from the normal depreciation allowance, that is to say from self-financing of the company, and from loans which we floated both in France and on foreign markets, some of which actually were in the United States.
>
> The entire project was part of the normal railroad investment program and it never exceeded 20 percent of our yearly investment.
>
> Furthermore, at $4 million a mile, the new line was really cheaper to construct than would have been a highway of equivalent capacity on that line.
>
> In terms of energy, per passenger, TGV consumes about 107 miles per gallon with a 65 percent load or—the way we like to express it—is that 10 second-class passengers cover the energy costs of a TGV run from Paris to Lyon.

Congressman Glickman asked Mayor Briare about the Las Vegas-Los Angeles corridor:

> Mr. GLICKMAN. I assume that you see some Federal role, or maybe you don't, in terms of the financing of this high-speed system?
>
> Mr. BRIARE. We do not know what the results are going to be yet, Mr. Chairman, of course, from the feasibility study. But we would expect that certain incentives could be enacted by Congress, if they do not already have the regulatory authority to govern it, for investment credits to private industry to do what was done in France.
>
> We are very interested in the information that we had that the U.S. companies have investments in the French TGV sys-

tem in the amount of $225 million. We would like to go and talk to those people.

Mr. GLICKMAN. You say U.S investors put in almost a quarter of a billion dollars into the French system?

Mr. BRIARE. Yes, Mr. Chairman. That was brought out during our interviews with the various consultants, they seemed to have been quite familiar with each other's activities and that was something that was brought up during our public meetings that we had on this.

Mr. GLICKMAN. You said you were the fourth or fifth corridor in intensity of travel?

Mr. BRIARE. I believe the best definition I have is, those corridors which have the greatest potential to operate a train without subsidy from the Federal Government. This was an Amtrak study. It was done on behalf of Amtrak.

I believe they studied 22 corridors and ranked them from 1st to 22d The corridor between Los Angeles and Las Vegas was ranked fourth, the corridor between San Diego and Las Vegas was ranked first.

Mr. GLICKMAN. OK. I think it is exciting that you are pursuing this project.

As you know, Amtrak has announced some interest through an affiliated entity, the American High Speed Rail Corp., to try to do something in the San Diego-Los Angeles corridor. I hope that your study will in fact not only include a Las Vegas-Los Angeles corridor, but how this would relate as a part of a national system of creating these corridors.

We are pleased to have you here. We look forward to hearing from you on your progress, specifically as to the results of the report to be finished, you say, sometime this fall.

Mr. BRIARE. October we expect.

Mr. Robert Casey, Executive Director of the Ohio Rail Transportation Authority responded to a question on the financing of the Ohio high speed rail system:

Mr. GLICKMAN. What about financing?

Mr. CASEY. Ohio has a plan for a 1-cent sales tax, based on a constitutional amendment which we think will be on the ballot this fall. It has been passed by a bipartisan vote in our house, and is now in our senate. We expect to hear now shortly that is has been reported out and then will go on the ballot.

Mr. GLICKMAN. How do you see this fitting in with some sort of national plan?

Mr. CASEY. Well, we always have said we can build our own facility, our own train. We were a voice crying in the wilderness some time ago. But now there is a lot of interest everywhere in the country. People have come to us. We have explained our plans, given them copies of all our studies and everything. But we feel that the Federal Government should get interested and should encourage this all over the Nation, but in doing so, it should be fair, it should treat all States equally, and not just permit an adventure in only California

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or Florida. There should be equal treatment for all the States. Each State should be able to take advantage of the Federal law if it desires to do so.

Mr. GLICKMAN. Go back to the financing. You talk about a 1-cent sales tax. If passed, what is that going to finance?

Mr. CASEY. That is going to finance the entire system which is going to be built in Ohio. It will take 15 years to build the entire system, which will cost about $5.7 billion.

Now that money, when it first starts coming in from the sales tax, will be invested, there will be investment income involved here too because we will not be able to build it fast enough to use the money coming in from the sales tax in the initial years. Later on the investment money will be used up and then we will be digging into the capital, you might say.

Congressmen Glickman and Goldwater asked Dr. Takahashi of the Japanese National Railways about the economics of the Shinkansen:

Mr. GLICKMAN. Your statement indicated the Shinkansen operates at a profit; is that correct?

Dr. TAKAHASHI. Also if you would kindly refer to diagram 7 on page 6 of the same reference material, you will see that it shows 3,169 units of revenue. The units are in millions of dollars, so the revenue is $3.169 billion. Next to that you can see expenses also indicated in millions of dollars, $1.871 billion for expenses. So it is run at a profit. There is a graph on the left of that diagram that shows the annual operating ratio of Shinkansen over the last several years.

Mr. GLICKMAN. Does the entire Japanese National Railroad operate at a profit?

Dr. TAKAHASHI. J.N.R. operated at a profit until 1965. Since then the Shinkansen and major metropolitan commuter trains, both public and private, have operated at a profit. Overall, however, JNR operates at a deficit.

Mr. GLICKMAN. Does the Japanese Government make up that deficit?

Dr. TAKAHASHI. The Japanese Government does not make up the deficit every year. We manage the deficit with loans. But every several years the Japanese Government does pitch in and help us to reduce our deficits.

Mr. GOLDWATER. The question I would like to ask is, in the ticket fare, the farebox, is the full capital outlay recovered over a period of time, including the costs for purchasing the rights-of-way, and the costs of building the system? Is it all recovered?

Dr. TAKAHASHI. If you would kindly also turn to page 5 of this reference material, there are figures for acquisition of rights-of-way. Table 5 on page 5. And if you would look at the breakdown of the total costs, land acquisition is only part of them, and all these costs, which include land acquisition are, have been, or will be recovered by ticket fares. And in connection with the question of the recovery of land acquisition costs, on page 6, there is diagram 7, showing the

percentage of capital costs of which the land acquisition costs are part.

Mr. GOLDWATER. It does not indicate on those charts what percentage of that revenue is made up by Government authorization and appropriations or Government contributions. And I guess in that regard, what percentage of the farebox would be looked upon as being subsidized?

Dr. TAKAHASHI. With respect to high-speed rail, that is the Shinkansen alone, the Government provided a subsidy only during the construction period. The Government subsidized a part of the interest we had to pay on loans during the construction period. After the Shinkansen started operating, the Government ceased to subsidize the Shinkansen.

Mr. GOLDWATER. Could you say that for JNR, the total system?

Dr. TAKAHASHI. The rule applied to the construction of the Shinkansen line applies to all other construction costs. But in the case of operaitng costs, the Government subsidizes 10 percent of our operational expenses.

Mr. GOLDWATER. For the total system?

Dr. TAKAHASHI. Maybe I can express it this way: 10 percent of JNR's total revenues come from Government subsidies.

Mr. GOLDWATER. Ten percent of the operating revenue.

Dr. TAKAHASHI. The Government has subsidized operating costs since 1965 in gradually larger amounts.

Mr. Gilson of Amtrak and the American High Speed Rail Corporation commented on this issue:

Mr. GLICKMAN. I have a couple of questions. First of all, how does the experience with Amtrak support an optimistic and profitable future for a high-speed rail passenger system in America?

Mr. GILSON. I would make a couple of points in that regard. First, the experience with Amtrak is akin to the experience in other railroads. There was quite an exchange that took place when Dr. Takahashi sat here a few moments ago about the relationship between the profitability of a high-speed service and the requirement for subsidy for conventional train service. This is the experience throughout the world. The French National Railroad also receives Government support, as do all other conventional train systems in the world. We think that the distinction is a crucial one between the economics affecting conventional trains and those affecting high-speed trains.

The 59-percent operating ratio in Japan for the bullet train is sufficient to throw off cash which is able to subsidize or offset losses in the conventional trains. The subsidy requirement in the form of interest reductions and direct grants for the Japanese railroads is about $4 billion in American a year. It is important to note that there is a significant distinction between high-speed and conventional service.

Mr. GLICKMAN. What was the $4 billion a year?

Mr GILSON. The total subsidy requirement for the Japanese National Railway system which is attributable to the losses accrued as a result of operation of conventional train service, even after factoring in the surplus funds which are available to the conventional trains as a result of the profits of the bullet train.

Congressman Benjamin asked Mr. Gilson about Japanese participation in the San Diego-Los Angeles route:

Mr. BENJAMIN. Well, let me ask you this. If I understand the scenario that is developing, the Japanese would be inclined to participate equity-wise about 25 percent of the total cost which would be about $300 million.

Yet, the technology that they would bring with them would represent about $200 million. So there is another $300 million that they are either contributing towards the construction, the tunneling or other aspects of it.

I know Japan is not a philanthropic institution, could you tell us why they are going to be so gracious? We should be grateful.

Mr. GILSON. I would be pleased to. First, I would say that we do not have unequivocal commitments for these funds. However, we have had extended discussions and we are confident that the funds will be forthcoming. We expect that the Japanese will invest either in the form of debt or equity substantially in excess of the export component from Japan and they will do this, in our opinion, because they will conclude, as they are already beginning to conclude, that this is a profitable project. They will make a business judgment that this is a supportable initiative in which they would want to participate as businessmen.

This is the basis on which we are operating it.

We are not seeking decisions to be made by investors in the United States or elsewhere on a basis other than their own economic best judgment. That is why the project has to be supportable on the basis of the economics. And the indications are that the Japanese, at least at this juncture, are of the belief that this circumstance exists with regard to Los Angeles to San Diego.

We expect that of the $2 billion, roughly $1½ billion will come from the United States, the remainder from Japan. There could be some other foreign involvement. We don't want to foreclose that.

I should say further that we expect that the vast preponderance of well over a billion and a half dollars will be spent in the United States under the leadership of American construction and management firms and that the employment effect of this, in terms of direct employment for the railroad line itself, will be to create about 1,000 new permanent railroad jobs and between two and four thousand permanent new support positions, not directly railroad employees but connected with the railroad operation.

Dr. Webb of Dalton, Dalton & Newport commented on financing options:

> How can we finance these high-speed rail corridors? Are there public and private options? Perhaps a more important question is: Can we finance high-speed rail without direct and active public involvement? To me the answer is clearly, no. It has never been done in history. It was not done in Japan. It was not done in France. I don't think that we will be an exception.
>
> Equally important, can there be active and innovative private financing methods used? The answer is with equal enthusiasm, is yes.
>
> The bottom line on any high-speed rail system will be the financing and that financing must be based on the economic viability of each corridor. Each corridor must be evaluated separately. Each will support a different mix of public and private participation on its own unique characteristics.
>
> One of the interesting aspects of high-speed rail is that it does not require a single financing program. In fact, it is far better to fit the financing scheme to the specific project. Let there be some variability.
>
> Can we justify public participation? Yes.
>
> Congressman Glickman indicated yesterday that if other transportation modes were saturated we would be able to look at some of the expenditures for high-speed rail as an offset against expenditures required to expand those other government supported travel modes. Also, we have frequently used transportation as a vehicle for stimulating economic growth.
>
> Some say that if foreign governments did it privately, why can't we? I think it is very important to understand that no country did it totally on a private basis. All had major government support.
>
> In France, for example, there was a total freight and passenger system on which this development was based. It was a fully integrated system. The French National Government guaranteed all the bonds. Twenty-two percent of passenger revenues in the French system are subsidized by the Government to keep the feeder passenger-lines fares low. The French financing plan is not all that dissimilar to a typical tax-exempt municipal financing program from a sewer plant where the revenues from the project pay back those bonds and they are backed by the Government. This could not have been done if the French construction costs were not as low as they indicated at $4 million a mile by avoiding the major construction costs associated with building in urban areas.
>
> Government participation can vary. There are a number of options: Direct subsidy; indirect subsidy in the form of loan guarantees, tax credits, interest rate subsidies; what I call sweeteners such as the new enterprise zone legislation, induced development around stations, and tax increment financing.
>
> There are also some innovative private financing alternatives. We know the system needs to be run as a business, and it should use as much private financing as possible.

The key to any private financing is cash flow, the cash generated over the operating expenditures. If there is a positive cash flow from operations, then you can get private money. If there is not, then you can't.

In any event, Government support would still be needed in some form of a guarantee, in my opinion. There are a number of private financing options that can be considered.

To list a few: Innovative use of depreciation allowances, collateral loans on selected parts of the system; vehicle leasing programs, granting of licenses or concessions for particular profit centers, and vendor/supplier financing.

In Ohio, our projections indicate about a $50 to $55 million surplus of operating revenues over operating costs. That is not close to enough money to finance the development of the total Ohio system. Perhaps it would finance between $500 million and $1 billion of the construction.

The current financing proposal, as Mr. Casey from ORTA indicated, is for 1-percent sales tax for the construction of the system. A 1-percent tax for 15 years would finance the complete construction of 550 miles on a pay-as-you-go basis without any bonds.

On the other hand, early indication for the San Diego-Los Angeles corridor would indicate that it could support a significantly higher proportion of private financing because the operating surplus is much larger. Current estimates show they would need about $200 million in operating surplus to finance the corridor construction wholly with private capital.

Thus, I think it is important to look at each corridor and let the financing plan fit that corridor. I do not see a situation where the Government will not have some form of participation.

You face a particular challenge in designing the Federal Government response and role. How do you stimulate the great diversity and entrepreneurship that is taking place in this country, yet design a coherent policy which provides the best response to our overall transportation system needs?

First, we see in high-speed rail the re-emergence of States as entrepreneurs in economic development. This should be encouraged. We should allow diversity. There should not be a single, sole way to do things, at least not right now.

Perhaps a good example would be the emerging corridors of the fifties. We called them turnpikes. They were initially developed by States based on hard economic criteria and they formed the foundation for the building of our nationwide interstate system.

Second, each corridor should stand on its own in market, economic and financial terms. Each corridor wil require a different mix of financing, serve different markets, have different institutional and organizational structures. They don't have to all be alike.

Third, we must accept that high-speed rail and freight systems must be separate. They don't mix from any aspect. Each needs control to support its own competitive position.

Fourth, there is a very important role for the Federal Government and national quasi-private companies in high-speed rail. It is critical. We need basic design and safety standards. We need a catalyst, a supporter, an information gatherer, a tester, a loan guaranteer. I think that the new American High-Speed Rail Corporation offers an exciting concept and idea that needs to be pursued. I could even see them constructing and operating some corridors as long as it is not required to be that. It is this kind of balance which is important and will be difficult for you to achieve. Thank you.

Congressman Glickman questioned Dr. Webb on this point:

Mr. GLICKMAN. I would like to finally ask you again, what the Federal role should be. In your testimony you indicated chief encourager, maybe loan guarantor, maybe there is a big difference between the two.

Dr. WEBB. I did offer a range of options.

Mr. GLICKMAN. What do you think the Federal Government's role should be regarding high-speed passenger rail systems? What should the government do?

Dr. WEBB. I have not closed on that personally as I look at the development of this technology in this country. Our policy should encourage as much private financing as can be supported. I am convinced that there will have to be loan guarantees for the systems to develop, even where we have a system where the cash flow covers construction costs. Loan guarantees where that happens, could be the difference between the system development or not. That is probably as far as I would go from the Federal Government.

I would not propose direct subsidy.

Mr. GLICKMAN. Are you familiar with the Farm Credit System in this country?

Dr. WEBB. No.

Mr. GLICKMAN. There is a system of financing through the Farm Credit System, established many years ago, that enables farmers to go and borrow money and the Farm Credit System finances that by selling certificates. They are not guaranteed by the Government but they are guaranteed by the full faith and credit of the United States, so ultimately they are guaranteed. But there is no real, what you would call day-to-day loan guarantee.

They are a quasi public-corporation. They exist only through the graciousness of Congress. So there may be a hybrid type of financing arrangement available other than the kind of loan guarantees that we are seeing now in Synthetic Fuels Corporations, where you have the direct Government involvement.

I assume that if the technology developed and it was being demonstrated in many parts of the country there may be other ways of financing it.

I suppose it depends on what stage of development you are in to determine what type of financing you would use.

Dr. WEBB. The first ones will be more difficult. Once it has been proven, as was stated earlier today, the financing will be easier.

The other point is what the economics of each corridor tell us. Whenever a private loan is guaranteed, we had better be sure that it is covered by the operations of the system. You can't guarantee a loan unless that cash flow is there to pay it back or it will end up being just a direct subsidy.

(D) ECONOMIC IMPACT OF HIGH SPEED RAIL SYSTEMS

Congressman Reuss indicated that high speed rail is an economic catalyst:

The Joint Economic Committee has necessarily been concerned with what is called the reindustrialization of America, and, as you know, Mr. Chairman, there are many ideas on this subject.

On looking things over, we decided that there are some ways in which we shouldn't go. One is to pick losers. We have been very good at that in the past, picking steel mills that were about to go under, shipyards about to be seized by the sheriff, and other feckless ventures. Picking losers both here and abroad, has not been a good way to go.

Picking winners sounds simply wonderful, but the only problem is how do you pick a winner? Some of the efforts in France and Japan, for instance, at picking winners have not been all that glorious.

We finally concluded that what makes the most sense is certainly not to pick losers, and not to try the impossible of picking all winners, but to pick catalysts—those industries and sectors which offer an opportunity of forward and backward and sideways motion which can set the economy going again.

Our list is not long. So far we have identified semiconductors, coal, and high-speed passenger rail in our 20 leading corridors, as the kind of catalysts which it is worthwhile in to back new forms of Government/private sector activity.

Mr. Robert Casey, Executive Director of O.R.T.A. commented on the potential economic benefits of the proposed Ohio rail system:

The project comes at a time when the boost it will give the state is vital. Ohio has been losing jobs and industry for more than a decade.

Ohio's major manufacturing industries are transportation, primary metals, fabricated metals, electrical machinery and nonelectrical machinery. All five of these industries, and many more, will be involved. Consider what occurred in Japan.

Construction of the 247 mi. Sanyo Shinkansen line meant the following to that country's economy: 219 primary contractors, 500 subcontractors and 550 manufacturing companies were engaged to handle the civil engineering and track work; 346 primary contractors, 500 subcontractors and 1,500

manufacturers were needed for the electrical work; 23 primary contractors and 500 subcontractors manufactured the rolling stock. The project consumed 286,000,000 cubic feet of concrete, 2,450,000 tons of cement, 279,000,000 cubic feet of aggregate, 580,000 tons of steel and iron and 8,903,000 KWH of electricity. Ohio's plans call for a complete system of 547 miles.

During the 15 year construction life of ORTA's initial project, 46.000 work years of jobs, involving more than 8,000 direct employees, will be created. When the multiplier effect works its way through the economy, job creation will swell to 150,000 work years. The estimated $5.7 billion construction cost will result in $20 billion in total economic impact. These numbers don't take into account the 2,700 permanent employees it will take to run the completed system.

Like Congressman Henry S. Reuss, I believe we can put the next generation to work making rail equipment, provide a balanced transportation system, and re-industrialize our nation—all by this one bold stroke! As he stated, "we can have an American revival, based on the revitalization of our railroads."

Dr. Takahashi, Vice President for Engineering of the Japanese National Railways:

> The success of the Shinkansen has not contributed only to the coffers of JNR. It has made significant contributions to the economic and social development of the regions it runs through.
>
> During the construction period, more jobs were created, not only in the construction work, but in the related industries, such as cement and steel.
>
> It has led to an increase in the overall economic activity of the areas along its route, thereby helping to balance economic development throughout Japan.
>
> In essence, the construction of the Shinkansen was the creation of a national resource. In metaphorical terms, it was the mining of a superhard metal with which we refurbished our economic and social infrastructure, providing an element that increases the productivity of our industries.
>
> The Shinkansen has also aided the Japanese economy through its energy efficiency. The per-passenger energy consumption of the Shinkansen is only about 20 percent of that of airplanes or private cars. This is a major consideration for a country that must import every drop of oil it uses.

Mr. Dickhart of the Budd Company commented on the potential economic impact of the Skytrain technology:

> To help meet the challenge of reindustrialization, a nationwide system of Skytrains operating between high-density population centers would insure a tremendous infusion of wealth into the American rail, steel, concrete, electronics, and other industries. Ultimately, we believe that consumer demand for travel by Skytrain will be sufficient to make a profit

for private investors. State or federal government assistance, in the form of long-term loan guarantees, grants, and funds for initial feasibility studies, may be required at the outset. We are aware of the serious budget constraints on Congress. We strongly believe, however, that such funds and guarantees will reap tremendous long-term economic benefits and government revenues for a comparatively small investment. In this regard, it is helpful to recall that between 1957 and 1976 the U.S. spent $75 billion on highways. By contrast, during the same period only some $1 billion was spent on the nation's railroads. We believe that consumer demand for Skytrain travel will lead to the reindustrialization, and strong economic growth, of the rail transportation industry, and others that serve it.

Similarly, a network of inter-city Skytrains would create tens of thousands of new jobs in the rail, and many related, industries. The economic "ripple effect" of a new, dynamic, and expanding industry would be vital to the depressed employment conditions in these important sectors of the economy, helping turn them into growth industries again.

Mr. J. R. Snyder, Chairman of the Railway Labor Executives' Association:

It is time for our country to stop lagging behind in the development of a truly balanced transportation system. This is especially true at a time when this country needs jobs as a basic part of a revitalized economy. And it needs jobs in support of a major industry. The rebuilding of a rail passenger car manufacturing industry could produce one of the greatest employment expansions since World War II.

A commitment to revitalizing our country's passenger railroad system makes good sense. Developing a high-speed rail corridor service will also foster business and employment opportunities in the areas served. This is evidenced by the corridor meetings held by Amtrak around the country along the routes specified in the April 1981 report.

Public officials and other members of the respective communities spoke enthusiastically about the economic benefits that development of these rail corridors could have. Many expressed the conviction that renewed rail passenger service would encourage the growth of business and reinvestment in downtown areas, and would greatly increase tourism, in addition to meeting daily business commuter needs.

Although it is regrettable that our Government is unwilling to make the commitment to implement a high-speed rail system, the Railway Labor Executives' Association lauds the intention of the newly formed corporation. For whether it be through Government funding or private capital, it is my judgment that the development of high-speed rail passenger service for our heavy population corridors can serve as the focal point for this country's reindustrialization.

The April 1981 Report on Rail Passenger Corridors, by the DOT and Amtrak, supports this conclusion. One of the re-

port's most striking findings is the number of jobs that would be generated by developing a number of rail corridors. Thousands of people would find new job opportunities in all sections of our country.

The Boston-New Haven corridor, for example, would require 3,719 new jobs. In the South, the Atlanta-Nashville corridor would require almost 2,500 additional employees. Over 4,400 new jobs would be created in the Midwest on the Chicago-Cincinnati corridor. In the Southwest, over 12,000 additional employees would be required for the Texas Triangle corridors. And 3,300 new jobs would be created on the Seattle-Portland corridor in the West.

In all, over 60,000 new jobs would be necessary to develop the 20 rail corridors discussed in the report. Thousands of other jobs would also be required for operation of the corridor service itself. There would be increased employment of engine and traincrews, onboard service personnel, and maintenance personnel.

This, however, represents only a part of the effect that the development of high-speed train technology can have upon the revitalization of the railroad industry. To successfully implement a high-speed rail passenger system in the United States, we must make the commitment to a first-class railroad passenger manufacturing industry.

Dr. Thomas Webb, Director of Development at Dalton, Dalton and Newport outlined the economic impact of the proposed Ohio high speed rail system:

The Dalton-Dalton-Newport consultant team has developed initial projections of the economic impacts which the proposed Ohio high speed rail system will generate. We have evaluated the range of direct and indirect effects on regions of the State, the entire State, and the midwest "heartland." I will discuss three areas of impact: construction impacts; operating impacts; structural impacts.

One caveat: Our economic studies, while based on the best available data using the most applicable econometric models from both the private and public sectors, are preliminary studies only. There are a lot of numbers: use them cautiously. I feel they are in the ballpark—concentrate on their magnitude and not the fourth decimal point. We have a number of studies and background reports available through ORTA. Our capital cost information was built up from every bolt and tie we projected for construction. We used Chase Econometric models as well as the best available 495 sector input/output RIMS model from the United States Bureau of Economic Analysis in the Department of Commerce.

CONSTRUCTION IMPACTS

The total estimated construction cost is about $5.7 billion in 1978 dollars with about $1.6 bilion for the Columbus-Cincinnati segment and approximately $1.3 billion for the Columbus-Cleveland segment (the 3C Corridor).

About one-half of the budget goes to wages. Over the entire construction period, it will require 46,000 person-years of work with peak employment between 7,000 to 8,000. The rest of the funds go toward the purchase of equipment and construction materials directly. This means about $2.8 billion for steel, cement, stone, fabricating, equipment, communication systems, etc.

Expenditures for the various components of the project are interesting:

	Millions
Structures	$2,000
Track work	800
Roadway preparation	400
Electrification	450
Right of way	80
Signals and communications	120
Vehicles	220

The direct industry purchases are also impressive:

	Millions
Primary metal products	$740
Quarry	99
Chemical and rubber	195
Fabricated metals	465
Transportation, communications and utilities	200
Wholesale and retail	295
Machinery	200

But that is only for starters. What the $5.7 billion really means, when the economic multiplier effects are taken into consideration, is at least $18 billion in total economic impact for Ohio and the region:

Over 150,000 person-years of wages—20,000 to 25,000 jobs in the peak year.

$6 to 9 billion in purchases from industry.

Hundred of millions of tax dollars paid by industry and workers.

For specific industries there are major implications; a few examples are:

For the chemical and rubber industry the $195 million in direct purchases increases to over $600 million of total impact.

The $200 million directly purchased from transportation, communications and utilities jumps to over $900 million.

$1.5 billion is generated for wholesale and retail trade.

Over $600 million is added to the finance, insurance and real estate industry.

The biggest impact is on households where about $4.5 billion is paid in wages, salaries and dividends.

OPERATING IMPACTS

Our conservative estimate is that the system will carry about 9 million people annually for approximately 1 billion passenger-miles per year. It is projected to generate about $155 million in annual revenues (1978 dollars). With esti-

mated operating and maintenance expenses of $105 million, about a $50 million gross margin is generated annually.

In current dollars the system will pump over $100 million annually into Ohio's economy in construction, maintenance, equipment, supplies, and wages—about 2,700 new jobs, $60 million in wages.

When the multiplier effects are considered, the annual level of economic activities generated by the operating system is about $400 million each and every year—8,000 to 10,000 jobs in the economy, from welders to T.V. repairmen.

We have been able to make some estimates of the operating expenditures generated in regions of the State. Let me take Columbus as an example. We assumed that Columbus will be the headquarters and maintain one-half of the lines between each of the major urban centers and Columbus. Using the RIMS model, we estimate $41 million annually in direct Columbus region expenditures by the system with $8 million lost to imports; that means a net of $33 million in direct regional expenditures. The gross annual impact is over $122 million on the Columbus SMSA when multiplier effects are included.

$36 million to the construction and maintenance trades.

$1.5 million to paper and printing.

$2.5 million to chemicals and rubber.

$5.5 million to transportation, communications and utilities.

$11.2 million to wholesale and retail trade.

$6.6 million for finance, insurance and real estate.

$11 million to services.

$39 million to households.

STRUCTURAL IMPACTS

Now, I would like to briefly discuss what I consider the most significant long-term economic impact—the structural effects on the State.

Transportation is at the core of all major economic development in history—from sailing ships to canals to roads to trains. This basic infrastructure is essential to any economic growth program.

One of the central economic considerations is the economic vitality of the "heartland," which was so effectively analyzed in *Forbes* last spring. There is much that can be said about the "heartland"—and you know most of it, the strengths and the weaknesses.

Forty million people, a GNP of over $350 billion, and world industrial leaders.

Concurrently over 400,000 manufacturing jobs lost in the last 10 years, a capital drift out of the region, and a negative federal balance of payments in just the last 5 years of over $10 billion.

Then, what happens to an economy when we:

Introduce a major, new, high technology transportation system linking all the industrial and commercial centers of the State.

Take the leadership in developing a new rail technology industry.

Build a more attractive environment to locate plants and corporate headquarters.

Create the economic vitality and growth which alters the economic psychology of the region.

It will assist the older industrial segments of the region which have and will continue to experience problems. It can provide new growth markets, improved competitive position, more jobs, and many job transfer opportunities. The entire State will change. Each region will be affected differently based on their current economic base and their ability to respond to new economic growth opportunities.

(E) Developing a Balanced National Transportation System

Congressman Benjamin, Chairman of the Appropriations Subcommittee on Transportation:

In its November report entitled "Case Studies in Private/Public Cooperation to Revitalize America," the Joint Economic Committee found that:

"One part of the answer in meeting the Nation's future transportation needs would be the establishment of a balanced transportation system: a system which capitalizes on the benefits of every mode of transportation, rather than extending the use of one or two modes into areas where they are not the most efficient or economical.

"An important component of a balanced transportation system, and one part of the solution in meeting future transportation demands, is a viable rail system including passenger operations."

The concept of a balanced approach to the Nation's transportation system is crucial. It has become increasingly evident that the Nation's highways, airways, and waterways are not capable of being exclusive transportation modes.

The United States is too vast, too diverse, and too dynamic to accept a sole mode. Each has its advantages and disadvantages, its exclusivity and its competitiveness.

Mr. James J. Harp, Manager of Program Development, Northrop Services, Inc.:

Much interest has been expressed here in the application of high-speed rail technology in meeting the passenger needs in high-density corridors. The future of American transportation is a much heavier subject. Indeed, the corridors approach is in my opinion another Band-Aid on a very much patched infrastructure. If we are to address the problems of the future and we accept the projections by both the congressional and executive studies plus the myriad of other litera-

ture on the future demands, then it is inescapable that, if we are not already, we will in the near future have our economic growth constrained by our transpotation system. None of the proposals we have studied to date address this problem. Rather, we have single-mode initiatives that in aggregate do not provide for even a modest growth in economic activity through the year 2000. It is continual catch-up, with the Federal Government as the bailor. This incremental approach has, we believe, led to some very misleading conclusions regarding high-speed rail and electrification. Similarly, the Japanese and/or French technologies are not universally exportable. The geography, culture, and social elements of those countries are not those of the United States. Our problems, our geography, and society are unique, as are our requirements and capabilities. A macro view of our needs leads us to an entirely different view of the future.

We believe that the time and circumstances are right for a major new innovation in transportation. As uniquely American as our other institutions. One that will capture the imagination and use our capabilities to their fullest. In the technical jargon of the industrial innovation analysts we see the favorable congruence of demand pull and technological push forces. We see a demand pull situation in which the present transportation infrastructure is not adequate—nor can it be easily structured—to serve even the low-growth forecast for transportation requirements in the year 2000. We see a technology push situation characterized by proven foreign high-speed rail systems, as well as advances in communications, and transmission of electrical energy that have far reaching implications for our national logistics posture. To address this challenge we must remove the blinders of modal bias and look with a macro view at the problems, our present capabilities, and our resources. Then in the American tradition apply imaginative innovation and develop a solution that will recapture our leadership and satisfy our economic and strategic needs well into the next century.

What we propose is innovative and bold. It addresses the transportation problems as they have been identified and documented. It is geared to economic growth, and will add to that projected growth. It will enhance our strategic posture and add to the national and civil defense reservoir. It does not challenge the existing railroads as the heavy freight and bulk mover, nor the trucks in their sphere of efficiency. It relieves the existing rail structure of the passenger burden and the airlines of the inefficiencies inherent in the short haul. It is a new mode of transportation geared to long-haul, high-value goods and medium-range passenger service. It is high-speed rail—passenger and intermodal—containerized freight. It is not nationalization, it is not subsidy in the traditional sense. It is positive geared to achieving a balanced system, and requires only facilitation by the Government.

What we propose is a national right-of-way network that would accommodate high-speed rail, communications, and

utility needs. An interstate and defense system that could be amortized over a broad spectrum of the economy. This system represents a logical next step in the evolution of a national transportation policy and associated action plan. Such an initiative would complete the development of a balanced transportation infrastructure and facilitate more effective functioning of a free and open marketplace for the provision of transportation services. It would compliment and reinforce deregulation, and would stimulate more effective development of intermodal capabilities.

Our concept envisions legislation to facilitate the creation of an interstate and defense railway system of approximately 21,000 miles of dedicated totally electrified, high-speed roadbed, with state-of-the-art communications and control aimed at serving both passenger and high-value freight movement. The track system would be designed to accommodate speeds of 150–200 miles per hour utilizing to the maximum extent practical existing transportation or utility rights-of-way. The route location and alinement will be designed for a projected life of 100 years. The primary system would not enter urban areas, there would be no crossings at grade, and remote access would be by high-speed interchanges where such interchanges are economically justified. Transfer facilities would be at 250–500 mile intervals, with some exceptions dictated by population, major ports, and communications centers. Electrification of the primary system allows for the use of the most available and economic source of energy into the 21st century. Where necessary electrical generating facilities would be constructed and/or expanded to satisfy system needs. With the developing high-efficiency transmission technology and the system right-of-way, there should be a minimum requirement for such construction. Communications and control will require the use of state-of-the-art sensors and automation to achieve the highest levels of safety and operating efficiency. Emphasis on intermodality is essential, and the design would incorporate high-speed passenger and containerized freight.

To build, operate, maintain, control, and insure rights of access to such a system will require a unique organization and management structure. We believe a publicly chartered, private corporation—a Comsat type of structure.

Funding of such a major program is, we believe, possible through the private sector. Our economic investigation to date indicates with realistic estimates of loading this system could generate $20 billion to $30 billion of revenue per year by the year 2000.

The long-term and near-term benefits of the system we call "Rail America" are significant.

Up to 1 million jobs in the construction, operation, and maintenance of the system throughout the construction phase, with obvious follow-on;

Positive environmental and energy impacts;

Commercial and strategic alternative to the Panama Canal;

Increased productivity and industrial revitalization; and

Vital enhancement of our defense posture and reduction of time in meeting our worldwide strategic commitments.

(F) Magnetic Levitation Super High Speed Rail Systems

Dr. Takahashi, Vice President for Engineering, Japanese National Railways, responded to a question on magnetic levitation:

Mr. Glickman. I just have one final question, magnetic levitation. When do you feel that magnetic levitation rail systems will be technologically feasible, and what are their primary technological probems? And how fast will you be able to go?

Dr. Takahashi. If you would again look at the material on page 20, it depicts the record of our experiences and experiments with magnetic levitation trains. In 1979, just as our research indicated, we attained a speed of 323 miles per hour. That was exactly the same result we predicted from our theories. We knew then that magnetic levitation is not a dream anymore, it is a fact, something which is actually going to be realized on a commercial basis. We are sure that magnetic levitation will be a future ground transportation mode providing service at over 300 miles per hour.

I would like to touch on another aspect of your question. We feel confident that we have solved all the technological problems of magnetic levitation as a transportation mode, but we are currently testing or doing research in the areas of safety, stability, dependability, and efficiency. That is what we are studying at this time. Another thing we are studying now is the design of more compact equipment for running this train. For these reasons, I think it will require a little bit more time before we can put that type of transportation system into regular commercial service.

Mr. Glickman. Do you have any estimates on when you will run your first commercially feasible magnetically levitated train?

Dr. Takahashi. Before the end of this year we are going to run the magnetic levitation train with actual passengers on it as a test run. After we get the results of these passenger-loaded test runs, we will have a better idea of when we can put it in service. We hope to have it running in Japan within 10 years.

Mr. Glickman. Do you have any estimates on operating costs of magnetic levitation versus conventional power?

Dr. Takahashi. Before we figure out how much operation costs will be, we have to thing about how much it will cost to construct it. Due to the peculiar topographical conditions in Japan, our estimate for the construction cost of this particular mode of train will be 1.2 times the cost of constructing a high-speed Shinkansen train for the same route.

Construction costs will be high in Japan, because of the necessity of building many tunnels and elevated bridges. The cost of the magnets would be relatively small in terms of the total costs.

In the United States, you would have lower construction costs due to the relatively flat topography. That means construction costs in comparison with those in Japan will be less. However, the relative cost of the magnets would be higher in terms of the total construction cost. And I think that will affect your operating costs. The cost of constructing a maglev system in the United States would probably be twice that of constructing a Shinkansen system here.

In addition to the construction costs, there will be high motive power costs because electrical costs increase in proportion to the speed. But since there would be no wheel-rail contact in order to run the maglev vehicle, maintenance and equipment costs would decrease. So, overall, the operating costs would probably be the same for magnetically levitated trains and Shinkansen type trains, because different factors would balance each other out.

Mr. William Dickhart, Assistant to the Technical Director, The Budd Company, outlined their magnetic levitation system, the "Skytrain":

Skytrain constitutes a quantum technological leap beyond any existing conventional rail ssytem. It incorporates technology which magnetically levitates passenger cars above an elevated guideway.

This technology, known as maglev, allows the Skytrain to literally fly above ground level. This system is being offered by Budd, which has the exclusive rights in the Western Hemisphere from its sister company, Thyssen Henschel of Kassel, West Germany. Thyssen and its associates have been developing this system for over a decade in Germany and in 1979 operated the first Maglev system in the world approved for passenger transport. Final full-scale testing of a 200-passenger vehicle on a 20-mile guideway will begin this summer in Emsland, Germany and the first completed Skytrain could be built and put into service by the mid-1980's.

Let me stress to the committee that Budd is an American company paying American taxes and providing thousands of Americans jobs. We believe the Skytrain concept offers the potential for tens of thousands of additional jobs in this country in an exciting new industry.

The Skytrain is an ultra-high-speed transport system in which vehicles are magnetically levitated, then propelled along an elevated guideway at speeds of 250 miles an hour.

These speeds are well beyond the 160 miles per hour achieved by more conventional trains in France, Japan, and elsewhere overseas. These high speeds, combined with the convenience of downtown-to-downtown service, give the Maglev technology a major potential market in principal intracity corridors of the United States and elsewhere in North and

South America. We believe the Skytrain will offer a competitive, time-efficient alternative to plane flights between high-density population centers, thus easing crowding and confusion in the Nation's airports.

Using maglev technology, the Skytrain operates free from conventional steel on steel rail limitations. There is no contact between the rail and the train in operation.

The passenger vehicle is equipped with electromagnet side packs which guide it along a magnetic track. It is powered by the traveling magnetic field created with the electromagnets on the vehicle which interact with the linear motors on the track. The Skytrain vehicle is pulled up from the rails by levitation magnets thus allowing it to hover above the guideway.

At the same time the suspension of the Skytrain actually surrounds the guideway thus eliminating the possibility of derailments. This unique capability adds immeasurably to the safety of the Skytrain compared with other forms of transportation, and allows it to operate in virtually any weather conditions. It also insures an amazingly quiet and comfortable ride.

As I have indicated, the Skytrain offers significant energy savings compared with highway or air transportation. The energy required for each seat per kilometer would be less than that required for a 60-watt lightbulb per hour.

Mr. GLICKMAN. Thank you, Mr. Dickhart.

Let me ask you a few questions. First of all, where are we in terms of the state-of-the-art of Skytrain technology? You have showed us the German track. You said that it had run before. Are we pretty close to being ready to move ahead with this?

Mr. DICKHART. Yes, we are. The development of the German maglev system, the 06 system, is complete. The vehicle, as I showed you, the 200-passenger vehicle, is nearing completion. The test track will be complete and ready for engagement of the vehicle in the late summer. So what remains at this point is demonstration of the system at the full speed. Now, in 1979, I also showed you a slide of the 05 vehicle, which was the first maglev vehicle that was licensed to carry passengers. During the exhibition the 05 vehicle carried some 50,000 or 60,000 people. So the technology is in place. It is ready to be exploited.

Mr. GLICKMAN. What speed are you talking about?

Mr. DICKHART. 250 miles an hour. That is 400 kilometers per hour. So it is a quantum jump beyond the speeds that we are talking for high-speed rail.

IV. SUMMARY OF TESTIMONY BY WITNESS

This Section Presents a Summary of the Testimony of Witnesses Who Appeared Before the Subcommittee.

Congressman Dan Glickman, Chairman of the Subcommittee on Transportation, Aviation and Materials of the Committee on Science and Technology, addressed the issues confronting rail transportation in the United States and objectives of the hearings.

> The purpose of these hearings is to assess the technological needs and opportunities of American rail transportation in order to lay the basis for future national transportation policy.

Congressman Henry Reuss, as Chairman of the Joint Economic Committee, expressed his belief that the improvement of the rail network could have a positive effect on revitalizing the American economy:

> The Joint Economic Committee has necessarily been concerned with what is called the reindustrialization of America. So far we have identified semiconductors, coal and high-speed passenger rail in our 20 leading corridors as the kind of catalysts which offer an opportunity to set the economy going again.

Congressman Reuss indicated that while heavy subsidization of the highway system and the heavier freight rail operating on the same track with passenger equipment spelled the end of domestic passenger rail, foreign countries made passenger rail work.

> Meanwhile, abroad—particularly in Japan, France, Germany, Great Britain, and other countries—great breakthroughs were being made and now, as your opening statement pointed out, Mr. Chairman, we may be in the happy position to take advantage of the technology developed by our friends. In the process, we can develop whole new industries dedicated to the manufacture of locomotive, passengers cars, electronic equipment and communications equipment.

Congressman Reuss commented on whether a government subsidy would be required.

> I am not sure a government guarantee would be needed. I am not sure that with private/public cooperation you can't put together something which would prove itself commendable to the private market.

Congressman Reuss responded to concerns with the rail industry's traditional labor management problems and their impact on a competitive feature.

> Everybody has to pitch in to make it work and that includes our friends in railroad labor. Labor has said that they won't let antiquated work rules stand in the way of reindustrializing America.

Dr. Dagobert Scher, Assistant General Manager for North America, French National Railroads, spoke of France's achievements in high speed rail transportation. Speaking of the new TGV project between Paris and Lyon:

> This project was helped by a government-appointed task force which agreed with us that we should build a fully dedicated line in an area which serves about 40 percent of the entire population of France. There are no revolutionary techniques in the TGV. By adopting conventional methods of rail transportation for developing speed as high as 200 and even 250 miles per hour, it opens the door to 21st century travel at the minimum costs. The total cost of the new line amounted to $1.5 billion. At construction costs of four million dollars a mile, the new line was cheaper to construct than would have been a highway of equivalent capacity. In addition, the trip to Lyon, which used to take four hours, has been reduced to two hours and 40 minutes. The high speed and frequent on-time departures are essential to public support.

Mr. Scher addressed the issue of financing the projects and government funding of operating deficits:

> The project was entirely financed by the French National Railways without any government subsidy. Funds came from—one-third from the normal depreciation allowance, and two-thirds from government-guaranteed loans which we floated. With regard to deficits, up to about 1976 the government would pay out the difference between the revenue and expenses. Since 1976, we had to go on the public market and try to cover that with loans. So that today we have reached a problem of interest that we have to repay. Presently, the entire program is being revised by the present administration.

Mr. Scher commented on the current use of the system:

> Roughly, we carry between 115,000 and 120,000 per week of operation. Out of this total, 5,000 to 7,000 passengers are absolutely new passengers; 1,000 to 1,500 coming from airlines, the rest coming from the road. The occupany ratio is 68 percent.

Mr. William Briare, Mayor, City of Las Vegas, discussed a proposed high-speed superspeed rail system between Las Vegas and Los Angeles:

> This month the City of Las Vegas begins its feasibility study. We expect it to be completed in October. This study will produce a financing plan, a design plan, an implementation plan, and an operating plan.

Mr. Daly, Director for the City of Las Vegas Economic Development, further amplified:

> The primary objective of the study is to select for the Las Vegas to Los Angeles corridor a high-speed ground transportation system that is feasible to be built in this decade; cost effective and economical in its operation, and therefore competitive with other modes of transportation.

In response to questions on the federal role in financing the high speed system, Mr. Briare replied:

> We would expect that certain incentives could be enacted by Congress, such as investment tax credit for private industry.

Mr. Robert Casey, Executive Director of the Ohio Rail Transportation Authority, commented on the state of our domestic rail technology:

> America, usually the world leader in technology, is virtually an undeveloped nation in the technology of moving people by high-speed rail. Yet this technology is nothing less than the key to both economic development, mobility of our people and petroleum independence. Accordingly to the National Transportation Policy Study Commission, we will need to almost double the infrastructure by year 2000. Yet there is little or no possibility of doubling our air facilities and highways in the next 18 years. Rail travel is the one mode in which, with new technology, improvements are possible.

Mr. Casey discussed their plans relative to high-speed rail:

> Ohio has been working for several years on a $5.7 billion program to connect our cities with high-speed trains. Lightweight, streamlined trains similar to the French TGV or Japan's famed intercity Bullet train will carry 10 million passengers annually. The estimated $5.7 billion construction cost will result in $20 billion in total economic impact.

Mr. Casey commented on H.R. 4028 and the role of Amtrak:

> I wish to strongly endorse H.R. 4028, with one reservation. Instead of Amtrak jurisdiction, a small commission should beestablished to administer the Rail Passenger Systems Program. States and groups of states should be encouraged to form authorities, which would build or authorize the needed system of high-speed trains. The announcement that Amtrak's High-Speed Rail Corporation will be privately financed undercovers the belief, long held in Ohio, that high-speed trains are profitable.

Mr. Casey then discussed financing of the system:

> Ohio has a plan for a one-cent sales tax, based on a constitutional amendment, which we think will be on the ballot this fall. That is going to finance the entire system.

Mr. William Harris, Jr., Vice President, Research and Test Department, Association of American Railroads, addressed his orga-

nization's efforts in freight research and development and their ability to assume greater research responsibility as a result of reductions in the Federal Railroad Administration's program. In response to questions on the feasibility of high speed passenger service, Mr. Harris indicated:

> The economic issues are the ones of profound concern to me, not the technological issues. The amount of subsidy that is required in all other passenger systems around the world is very large. In addition, mixing of heavy freight and high speed passenger traffic has not proved to be satisfactory.

Mr. Robert Blanchette, Administrator, Federal Railroad Administration, echoed Mr. Harris' comments.

> There is no technological impediment to high speed passenger transport. The problems are primarily economic and environmental. I should be most surprised if railroads found a rate of return to justify reinvesting in the passenger business.

In responding to questions on the appropriate Federal role in rail research and development, Mr. Blanchette replied:

> I think that if we keep our thrust in the safety area and let private industry ply its effort in those things which are susceptible to commercial exploitation, we have struck a good balance.

Mr. J. R. Snyder, National Legislative Director, United States Transportation Union, voiced his support for a high-speed rail transportation system in the United States.

> It is my judgment that the development of high-speed rail passenger service for our heavy population corridors can serve as the focal point for this country's reindustrialization. I feel that the Federal government should participate in the financing of this.

Mr. Milton Pikarsky, Director of Transportation Programs, Illinois Institute of Technology Research Institute, advocated a stronger commitment to research and development.

> The limitations on research spending we see today are barriers themselves to technological utilization and thus will have a substantial effect on the long-term economic viability of the railroad industry. It is the appropriate role of government to encourage additional research. I feel that the areas of energy conservation, safety standards, hazardous materials movement and bulk commodities movement deserve greater attention.

Mr. John C. Dwyer, Vice President and General Manager, Locomotive Marketing Division, General Electric Company, presented views on Federal R&D and high speed transport.

> Our principal message that I have tried to bring here is that really there is not a technological barrier to providing the service that is the subject of your committee hearing. It is simply a decision as to whether or not it is in the best inter-

ests of this country in meeting social needs of the people to provide that service, recognizing, as you point out, it would undoubtedly require significant public funding. As far as research and development is concerned, safety is an area that should be researched in the public sphere and that, I believe, should be the extent of Federal involvement in the area of research and development. I think private industry is fully capable and is continuing to do that research as far as the existing freight transportation system on the U.S. rails. If there is a demand for high-speed passenger service, it can be provided by U.S. industry also.

Congressman Adam Benjamin, as Chairman of the Transportation Subcommittee of the Appropriations Committee, described support of a Japan-U.S. group to discuss trade and technology transfer.

> The Committee Report of Public Law 97–102 (1982 Transportation Appropriations Act) stated support of a Japan-U.S. Rail Congress and found that high speed train services in other countries demonstrated that high speed rail could be financially self-supporting. The conferees also concluded that adequate private capital was available.

Congressman Benjamin responded to the question of the Federal role in high speed passenger rail.

> The initial role has to be one of encouragement and that is the stage that we are presently at. I would not rule out the fact that we may have to provide right-of-way, some assurances of availability of credit and even testing sites for the equipment and technology as it is employed in the United States.

Dr. Koji Takahashi, Senior Vice President, Engineering, Japanese National Railways, discussed the reasons for their successful Shinkansen high speed system.

> The high frequency of service and the very convenient reservation system have no doubt contributed. But I believe greatest cause lies in the accident-free and highly punctual service offered.

Dr. Takahashi noted the benefits accrued from the system.

> It has led to an increase in the overall economic activity of the areas along its route, thereby helping to balance economic development throughout Japan. In metaphorical terms, it was the mining of a super-hard metal with which we refurbished our economic and social infrastructure, providing an element that increased the productivity of our industries. In addition, the per-passenger energy consumption is only about 20 percent of that of airplanes or private cars.

Japan's efforts in future rail technology were then discussed by Dr. Takahashi.

> Based on our assumption that 200 miles per hour is the practical limit for rail/wheel contact trains, we have been developing a faster train that does not rely on rail/wheel contact. The

> superspeed magnetically levitated vehicle set a new land speed record of 323 miles per hour on its 4.6 mile test track in December, 1979. We would like to run a revenue service magnetic levitation train within 10 years.

Lawrence D. Gilson, Vice President, Corporate Development, Amtrak, described the formation of a new private company to encourage high speed rail development.

> We have brokered the creation of the American High Speed Rail Corporation that will coordinate the conduct of feasibility studies, arrange financing, oversee construction and operate new high speed rail systems.

Mr. Gilson identified those factors that are essential to the successful introduction of high speed rail service.

> These factors include at least:
>
> (1) high-density, heavily travelled transportation corridors in which existing transportation alternatives are strained to capacity.
>
> (2) access to a proven technology in order to avoid the necessity of engaging in extensive, expensive research and development.
>
> (3) availability of already assembled rights-of-way.
>
> (4) a relationship between the operator of the high speed train system and Amtrak to acquire operating rights on Amtrak-owned routes and use of Amtrak national facilities.
>
> (5) strong Federal, state and local support to help address institutional issues.
>
> (6) heightened understanding in the American financial community of the factors which distinguish the economics of high-speed trains from other kinds of railroad financing projects.

In discussing the potential high speed system between Los Angeles and San Diego, Mr. Gilson explained why the technology was limited to the Japanese bullet train technology.

> We do expect to use the Japanese technology and the reason for that is that we are convinced that we must have a proven technology that has worked and that has demonstrated its profitability in the marketplace in order to attract private investment.

Mr. William Dickhart, Assistant to the Technical Director, The Budd Company, as a representative of the last U.S. manufacturer of passenger rail cars, described the magnetic levitation system which they have licensed from their parent German company, Thyssen Henschel.

> Thyssen and its associates have been developing the Skytrain system for over a decade. Full scale testing of a 200 passenger vehicle on a 20 mile guideway will begin this summer. The first completed Skytrain could be built and put into service by the mid-1980's.

Mr. Dickhart spoke about the state of rail technology in the U.S. and how the Skytrain would enhance the U.S. position.

> We are certainly behind in the application of technology but not behind as far as the technology is concerned. We firmly believe that the Skytrain technology is dramatically different and superior to high-speed trains elsewhere in the world. We have been forced to compare with foreign industries that have received long-term government subsidies of their research and development efforts. In the manufacturing of rail cars, these foreign government subsidies have helped insure that most cars destined for the U.S. marketplace are being procured abroad. This costs thousands of U.S. jobs and adds to our burgeoning balance-of-trade deficit. With the Skytrain concept, we at Budd are determined to stop this flow of American jobs and money abroad by offering the most advanced technology of its kind here at home.

Mr. John Parke Wright, Chairman, Florida High Speed Rail Committee, spoke about that state's high speed rail project and cooperative arrangements with the Japanese.

> We would hope that through cooperation with Japan in the form of technology exchange and low interest project financing, this project will become a symbol of economic and technological cooperation between our two countries.

Mr. Thomas R. Webb, Director of Development, Dalton, Dalton and Newport, address the criteria for assuring a coherent policy for overall transportation system needs.

> We see in high speed rail the reemergence of states as entrepreneurs in economic development. We should allow diversity. Each corridor should stand on its own in market, economic and financial terms. We must accept high speed rail and freight systems as separate. Finally, there is a very important role for the Federal government. We need a catalyst, a supporter, an information gatherer, a tester, a loan guaranteer.

Mr. James J. Harp, Manager of Program Development, Northrop Services, Inc., outlined the current national transportation predicament, and identified high speed rail as the most cost effective focus for a major effort to revitalize the transportation system.

> Except for rail, the general purpose transportation modes—air, water, and highway—are working at or near their current physical capacity or control limits. Though rail has its own peculiar set of problems and much of its physical plant is in a deteriorating state, for the most part it is operating far below its physical and technical limits. Close examination reveals that rail mode offers a cost-effective focus for a major effort to significantly expand the capacity and overall service characteristics of the total transportation system.

Mr. Harp outlined their proposal for "Rail America," a national high-speed rail and right-of-way network:

> What we propose is a national right-of-way network that would accommodate high-speed rail, communications, and utility needs. An interstate and defense system that could be amortized over a broad spectrum of the economy. This system represents a logical next step in the evolution of a national transportation policy and associated action plan. Such an initiative would complete the development of a balanced transportation infrastructure and facilitate more effective functioning of a free and open marketplace for the provision of transportation services.
>
> Our concept envisions legislation to facilitate the creation of an interstate and defense railway system of approximately 21,000 miles of dedicated totally electrified, high-speed roadbed, with state-of-the-art communications and control aimed at serving both passenger and high-value freight movement. The track system would be designed to accommodate speeds of 150–200 m.p.h. utilizing to the maximum extent practical existing transportation or utility rights-of-way.
>
> To build, operate, maintain, control, and ensure rights of access to such a system will require a unique organization and management structure. We believe a publicly chartered, private corporation—a Comsat type of structure.
>
> Funding of such a major program is, we believe, possible through the private sector. Our economic investigation to date indicates with realistic estimates of loading this system could generate $20 million to $30 billion of revenue per year by the year 2000.

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